Astrocytic Ca^{2+} Levels are Regulated by Estradiol

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Introduction

- Astrocytes have been shown to display excitability, based in cytoplasmic calcium level increases. Astrocyte activity is known to modulate neurotransmitter release and neuron excitation (Figure 1).
- 17β-Estradiol (E2) is an estrogen hormone.
- This study examines the effect of E2 on astrocytic activity in the CA1 region of the hippocampus.
- Specifically, this project examines whether E2 will induce calcium events in astrocytes.

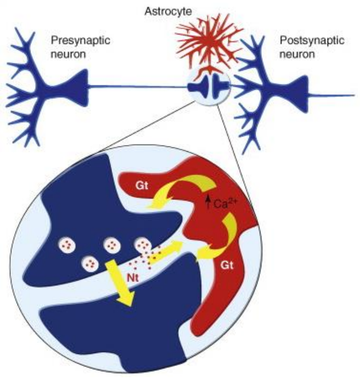


Figure 1. Tripartite Synapse. Information flows bidirectionally between astrocytes and neurons (1).

Methods

Ca2+ Imaging: Astrocytes in the hippocampal CA1 region were loaded with calcium indicator Fluo-4AM. They were then targeted with a pressure pulse using a glass micropipette filled with 92µM E2. Astrocytic Ca2+ concentration was monitored using confocal microscopy.

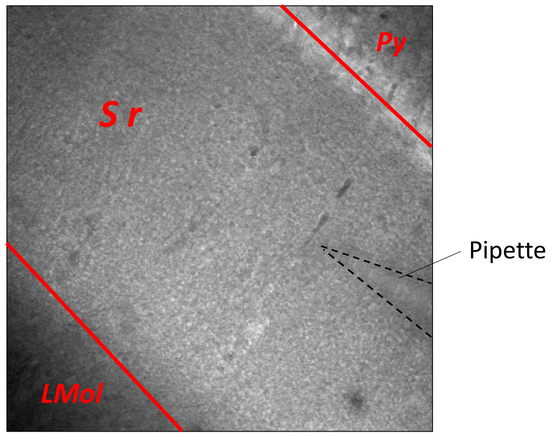


Figure 2. DIC image of the hippocampal CA1 region. Placement of glass micropipette and view of CA1.

Figure 3. β-Estradiol Activates Astrocytes

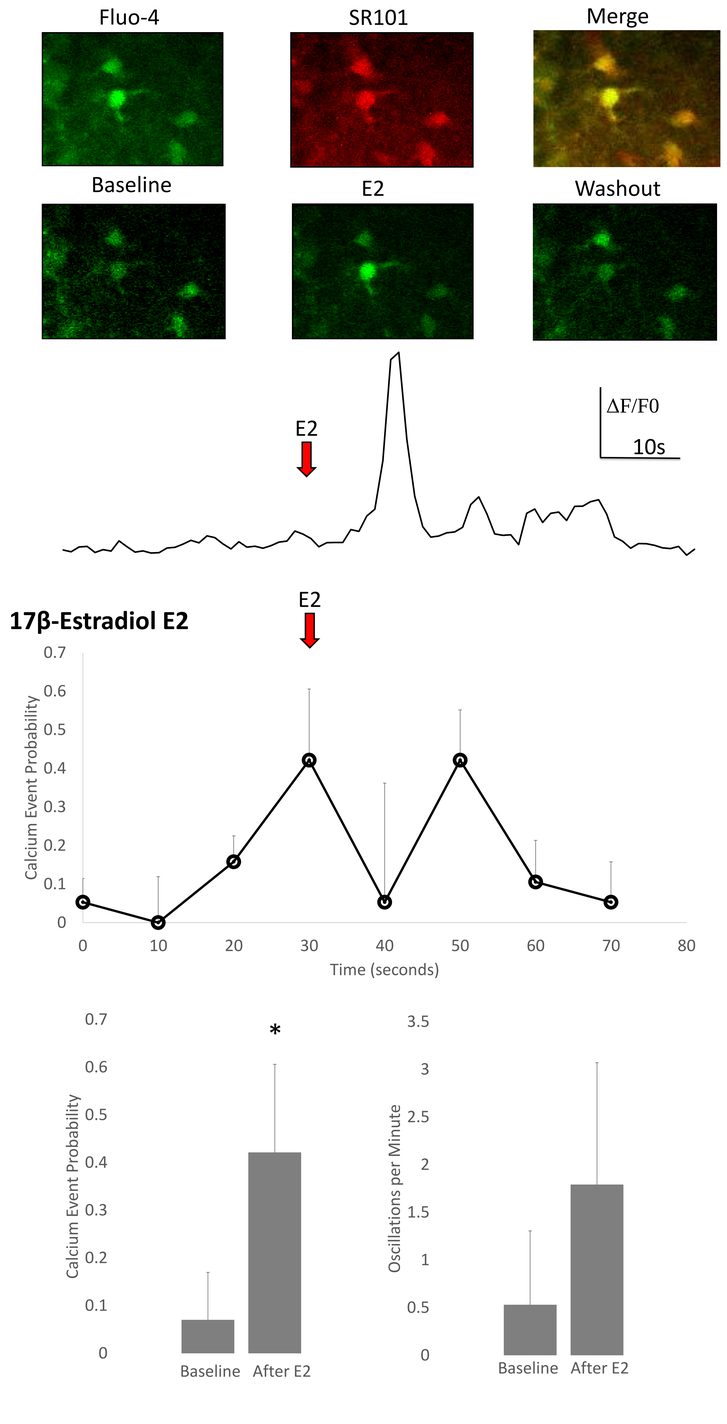
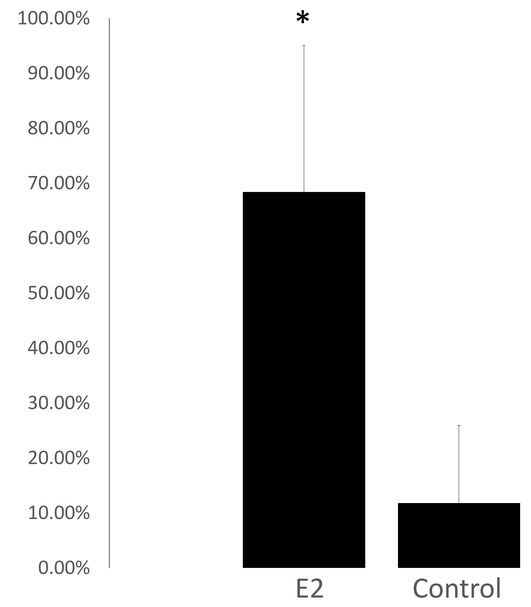


Figure 4. Proportion of Astrocytes Responding to Estradiol



Conclusion

- β-Estradiol modulates astrocytic activity in the CA1 region of the hippocampus
- E2 increases calcium event probability and oscillation frequency in astrocytes
- 68.4% of astrocytes in the CA1 region respond to estradiol

Future Directions

- Examine the influence of sex in the role of estrogen and astrocyte modulation, as well as the effect of E2 on ovariectomized females
- Establish the specificity of the effects of β-Estradiol through the application of inactive, but otherwise identical, hormone α-Estradiol
- Confirm astrocytic Ca2+ source by using IP3R2-/- mice to block calcium releases from internal stores
- Apply E2 in the presence of E2 antagonists in order to confirm the role of E2 in astrocytic activity

Citations

1. Perea, Gertrudis, Marta Navarrete, and Alfonso Araque. "Tripartite synapses: astrocytes process and control synaptic information." *Trends in neurosciences* 32.8 (2009): 421-431.